



LES FACULTÉS
DE L'UNIVERSITÉ
CATHOLIQUE DE LILLE

Univariate Models Examples

UNIVARIATE TESTING

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Part 1: Introduction to Univariate Statistical Tests

1.1 Definition and Significance

- Define univariate statistical tests
- Explain the importance of univariate analysis in research

1.2 Types of Data

- Categorical vs. continuous data
- Levels of measurement: nominal, ordinal, interval, and ratio

1.3 Assumptions of Univariate Tests

- Independence of observations
- Normality of data distribution
- Homogeneity of variances

Part 2: Tests for Continuous Data

2.1 One-Sample t-test

- Purpose and assumptions
- Steps to conduct the test
- Interpretation of results

2.2 Paired Samples t-test

- Differentiating between paired and independent samples
- Application and interpretation

2.3 One-way ANOVA

- Use and assumptions
- Post-hoc tests and their importance
- Interpreting the results

2.4 Non-parametric alternatives

- Wilcoxon Signed Rank Test
- Mann-Whitney U Test
- Kruskal-Wallis Test

Part 3: Tests for Categorical Data

3.1 Chi-Square Test of Independence

- Purpose and assumptions
- Steps to conduct the test
- Interpretation of results

3.2 Fisher's Exact Test

- When and why to use Fisher's test
- Application and interpretation

3.3 McNemar's Test

- Comparing paired proportions
- Use-cases and interpretation

Part 4: Choosing the Right Test and Practical Application

4.1 Decision Trees and Flowcharts

- Criteria for selecting the appropriate test
- Visual aids in decision-making

4.2 Limitations and Pitfalls

- Common errors in applying univariate tests
- Importance of assumptions and their verification

4.3 Software and Tools for Analysis

- Introduction to software like SPSS, R, and Python.
- Demonstrating a sample analysis

4.4 Reporting Results

- Importance of clear communication
- APA guidelines for reporting statistics

KEYWORDS (NEW)

ANOVA 1

Anova à 1 facteur

Test des rangs signés de Wilcoxon

ANOVA (Analyse de la variance)

Test de fisher

Test Z écart réduit

Courbe ROC

ANOVA à un facteur

Test du χ^2 d'ajustement

Comparaison de moyennes

Test paramétrique

Test de Mann-Whitney

ANOVA factorielle

Test du χ^2 d'homogénéité

Test du χ^2 d'indépendance

Analyse de covariance (ANCOVA)

Test de χ^2

Test t de Student

Test sur la moyenne

Tests de comparaison de moyennes et proportions

Test de normalité

Analyse de la variance

CHAPITRE 7 • TESTS PARAMÉTRIQUES ET NON PARAMÉTRIQUES

7.1 Introduction à la notion de tests..
7.2 Tests de comparaison avec une norme.
7.3 Test de comparaison entre deux populations indépendantes
7.4 Test de comparaison entre deux populations non indépendantes
PROBLEMES.
SOLUTION DES EXERCICES
SOLUTION DES PROBLEMES.

CHAPITRE 8 • TESTS DU KHI-DEUX.

8.1 Test du χ^2 d'indépendance.
8.2 Test du χ^2 d'adéquation d'une loi à une loi donnée
8.3 Test exact de Fisher
8.4 Test de Mac-Nemar.
EN RÉSUMÉ
EXERCICES
SOLUTION DES EXERCICES.

CHAPITRE 10 • ANALYSE DE LA VARIANCE À UN FACTEUR

10.1 Introduction..
10.2 Modélisation statistique
10.3 Test de comparaison de plusieurs espérances .
10.4 Vérification des trois conditions fondamentales et conclusion
10.5 Comparaisons multiples
10.6 Puissance des tests de l'analyse de la variance à un facteur

3.1 Echantillonnage
3.1.1 Moyenne et variance empiriques
3.2 Estimation paramétrique ponctuelle
3.1.2 Fréquence •
3.2.1 Estimateur ponctuel
3.2.2 Qualité d'un estimateur
3.2.3 Quelques estimateurs classiques •
3.2.4 Estimation par la méthode du maximum de vraisemblance .

4 Intervalles de confiance
4.1 Estimation d'une proportion par intervalle de confiance
4.2 Moyenne •
4.3 Variance

5 Notion de test d'hypothèse
5.1 Hypothèse nulle, risques de première et deuxième espèce
5.2 Mécanique des tests d'hypothèse

6 Test d'indépendance
6.1 Test d'indépendance de deux variables qualitatives
6.2 Test d'indépendance de deux variables quantitatives : test de corrélation nulle

7 Tests de conformité en loi
7.1 Cas général
7.1.1 Test d'adéquation du χ^2
7.1.2 Test de Kolmogorov-Smirnov
7.2 Test de normalité .
7.2.1 Méthodes graphiques : Droite de Henry
7.2.2 Test Jarque-Bera (ou test de Bowman-Shelton)|

8 Test sur les pourcentages
8.1 Relation test et intervalles de confiance.
8.2 Test de conformité
8.3 Test d'homogénéité

9 Tests sur Moyennes et Variances
9.1 Test sur les moyennes
9.1.1 Test de conformité
9.1.2 Test d'homogénéité : populations indépendantes
9.2.1 Test de conformité
9.2.2 Test d'homogénéité

10 Région critique

- Univariate Statistical Tests
- Statistical Analysis
- Research
- Types of Data
- Categorical Data
- Continuous Data
- Levels of Measurement
- Assumptions
- Independence of Observations
- Normality of Data Distribution
- Homogeneity of Variances
- One-Sample t-test
- Paired Samples t-test
- One-way ANOVA
- Post-hoc Tests
- Non-parametric Tests
- Wilcoxon Signed Rank Test
- Mann-Whitney U Test
- Kruskal-Wallis Test
- Chi-Square Test of Independence
- Fisher's Exact Test
- McNemar's Test
- Choosing the Right Test
- Decision Trees
- Data Analysis Software
- SPSS
- R
- Python
- Reporting Results
- APA Guidelines

In the context of the course on "Univariate Statistical Tests," which covers topics related to univariate analysis, various types of tests for continuous and categorical data, and choosing the right test, let's explore a use case related to healthcare research. We will focus on selecting the appropriate univariate statistical test for analyzing healthcare data.

Description:

In this use case, we will assume the role of a healthcare researcher who wants to analyze data related to the effectiveness of two different treatments for a specific medical condition. We have collected data from patients, and our goal is to determine whether there is a significant difference in treatment outcomes between the two groups.

Key Components:

Univariate Statistical Tests for Continuous Data: We will consider using the one-sample t-test, paired samples t-test, and one-way ANOVA to analyze continuous data, such as changes in patients' blood pressure after treatment.

Univariate Statistical Tests for Categorical Data: We will explore the chi-square test of independence, Fisher's exact test, and McNemar's test to analyze categorical data, such as the presence or absence of side effects in patients.

Decision Trees and Flowcharts: We will create a decision tree or flowchart to guide us in selecting the appropriate statistical test based on the nature of the data and research questions.

Healthcare Research Scenario:

Suppose we have conducted a study to compare the effectiveness of two different treatments (Treatment A and Treatment B) for hypertension. We collected data from 100 patients who were randomly assigned to one of the two treatments. Here's how we can apply univariate statistical tests to analyze this healthcare data:

Python Code Example (Choosing the Right Test for Healthcare Research):

```
1 import numpy as np
2 import pandas as pd
3 from scipy import stats
4 from sklearn.tree import DecisionTreeClassifier, export_text
5
6 # Load healthcare data
7 data = pd.read_csv('healthcare_data.csv')
8
9 # Define variables for analysis
10 treatment_a = data[data['Treatment'] == 'Treatment A']
11 treatment_b = data[data['Treatment'] == 'Treatment B']
12
13 continuous_variable = 'Change_in_Blood_Pressure'
14 categorical_variable = 'Side_Effects'
15
16 # Create a decision tree for test selection
17 X = data[['Treatment', 'Change_in_Blood_Pressure', 'Side_Effects']]
18 y = data['Outcome'] # Outcome variable indicating treatment success
19
20 # Fit a decision tree classifier
21 decision_tree = DecisionTreeClassifier()
22 decision_tree.fit(X, y)
23
24 # Visualize the decision tree rules
25 tree_rules = export_text(decision_tree, feature_names=list(X.columns))
26 print(tree_rules)
27
28 # Based on the decision tree rules, select the appropriate test
29 # Perform the chosen univariate statistical test and report results
30 # (e.g., t-test for Change_in_Blood_Pressure, chi-square test for Side_Effects)
31
```

In this code, we load healthcare data, create a decision tree to guide test selection, and use the decision tree's rules to choose the appropriate univariate statistical test. We then perform the selected test to analyze the data and report the results.

This use case demonstrates how to leverage univariate statistical tests and decision trees to make informed decisions in healthcare research, ensuring that the right statistical analysis is applied to answer specific research questions.

- Rosner, B. (2015). *Fundamentals of Biostatistics*. Cengage Learning. (Covers t-tests, ANOVA, and assumptions)
- Field, A. (2018). *Discovering Statistics Using IBM SPSS Statistics*. Sage Publications. (Comprehensive overview of univariate tests and SPSS usage)
- Moore, D. S., McCabe, G. P., & Craig, B. A. (2017). *Introduction to the Practice of Statistics*. Freeman and Co. (One-sample and paired t-tests, ANOVA, and Chi-Square tests)
- DeGroot, M. H., & Schervish, M. J. (2018). *Probability and Statistics*. Pearson. (Focuses on mathematical foundations of statistical tests)
- Tabachnick, B. G., & Fidell, L. S. (2018). *Using Multivariate Statistics*. Pearson. (Includes a chapter on univariate analysis)
- Wilcox, R. R. (2016). *Introduction to Robust Estimation and Hypothesis Testing*. Academic Press. (Non-parametric alternatives)
- Lehmann, E. L., & Romano, J. P. (2006). *Testing Statistical Hypotheses*. Springer. (Theory of hypothesis testing, including univariate tests)
- Salkind, N. J. (2016). *Statistics for People Who (Think They) Hate Statistics*. Sage Publications. (Great for beginners and covers most univariate tests)
- Siegel, S., & Castellan, N. J. (1988). *Nonparametric Statistics for The Behavioral Sciences*. McGraw-Hill. (Covers non-parametric alternatives)
- Conover, W. J. (1999). *Practical Nonparametric Statistics*. Wiley. (Focus on non-parametric tests for univariate data)
- Pallant, J. (2016). *SPSS Survival Manual*. Open University Press. (SPSS and data analysis)
- Daniel, W. W. (2009). *Applied Nonparametric Statistics*. Cengage Learning. (Wilcoxon, Mann-Whitney, Kruskal-Wallis)
- Maxwell, S. E., & Delaney, H. D. (2004). *Designing Experiments and Analyzing Data: A Model Comparison Perspective*. Lawrence Erlbaum Associates. (ANOVA and model comparison)
- Agresti, A. (2018). *An Introduction to Categorical Data Analysis*. Wiley. (Chi-Square and Fisher's tests)
- Kirk, R. E. (2018). *Experimental Design: Procedures for the Behavioral Sciences*. Sage Publications. (Design issues in univariate testing)
- Howell, D. C. (2019). *Statistical Methods for Psychology*. Cengage. (Psychological applications, APA guidelines)
- Stevens, J. P. (2009). *Applied Multivariate Statistics for the Social Sciences*. Routledge. (Includes a section on univariate tests)
- Dyer, R. A., & Nason, G. P. (2016). *ggplot2: Elegant Graphics for Data Analysis*. Springer. (Data visualization with R)
- Judd, C. M., McClelland, G. H., & Ryan, C. S. (2017). *Data Analysis: A Model Comparison Approach to Regression, ANOVA, and Beyond*. Routledge. (Focus on model comparison in ANOVA)
- Ho, R. (2013). *Handbook of Univariate and Multivariate Data Analysis and Interpretation with SPSS*. Chapman and Hall/CRC. (Practical guide to data analysis in SPSS)

Explore the fundamental principles of "Univariate Statistical Tests" in this comprehensive course designed to provide you with a robust understanding of key concepts, practical applications, and the significance of statistical analysis in research.

In the initial section, "Introduction to Univariate Statistical Tests," you will define univariate statistical tests and grasp their critical role in research. Understanding the importance of univariate analysis in research is essential for drawing meaningful conclusions from data. Moving forward, you'll explore the diverse "Types of Data" encountered in research, distinguishing between categorical and continuous data. You'll delve into the levels of measurement, encompassing nominal, ordinal, interval, and ratio data, which are essential considerations when choosing appropriate statistical tests.

The course proceeds with an exploration of the "Assumptions of Univariate Tests." You'll delve into the critical assumptions underpinning statistical tests, including the independence of observations, normality of data distribution, and homogeneity of variances. Understanding these assumptions is crucial as they guide the selection and interpretation of statistical tests.

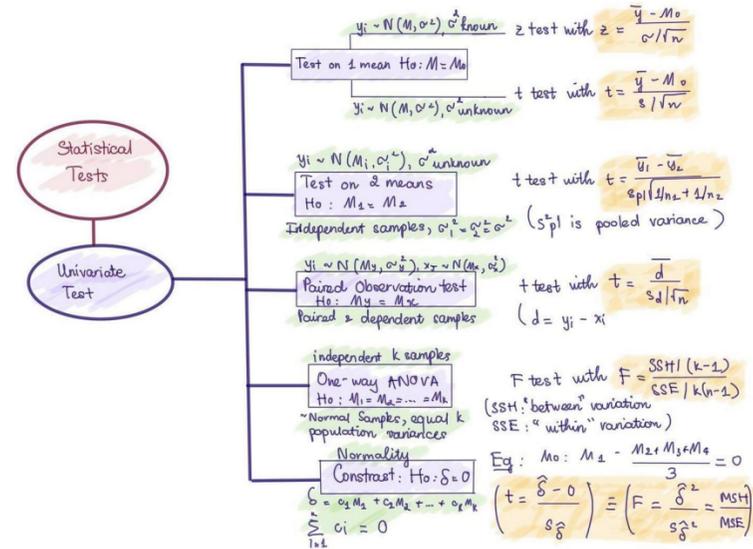
In "Tests for Continuous Data," you'll navigate through a variety of essential statistical tests. You'll start with the "One-Sample t-test," understanding its purpose, assumptions, and the step-by-step process to conduct the test. Interpretation of results will equip you with the skills to draw meaningful insights from your analysis. Next, you'll explore the "Paired Samples t-test" and differentiate between scenarios requiring paired or independent samples analysis. You'll delve into the application and interpretation of this test.

"One-way ANOVA" takes center stage as you learn about its utility and assumptions. You'll also uncover the importance of post-hoc tests in ANOVA and how to interpret the results effectively. In addition, you'll explore non-parametric alternatives such as the "Wilcoxon Signed Rank Test," "Mann-Whitney U Test," and "Kruskal-Wallis Test," expanding your analytical toolkit to address scenarios where parametric assumptions are not met.

Transitioning to "Tests for Categorical Data," you'll delve into categorical data analysis. The "Chi-Square Test of Independence" will be a focal point, including its purpose, assumptions, and the step-by-step procedure to conduct the test. You'll gain the ability to interpret results and assess relationships between categorical variables. Additionally, you'll explore "Fisher's Exact Test," understanding when and why it is employed and how to interpret the outcomes. "McNemar's Test" will be introduced, focusing on comparing paired proportions, use-cases, and interpretation.

In "Choosing the Right Test and Practical Application," you'll develop the skills to make informed decisions in selecting appropriate statistical tests. Decision trees and flowcharts will serve as visual aids in your decision-making process. You'll also gain insights into the limitations and pitfalls commonly encountered when applying univariate tests, emphasizing the importance of assumptions and their verification. Furthermore, you'll be introduced to software and tools like SPSS, R, and Python, and witness a sample analysis to reinforce your understanding. Finally, you'll explore the significance of reporting results clearly and adhere to APA guidelines for reporting statistics, ensuring effective communication of your findings.

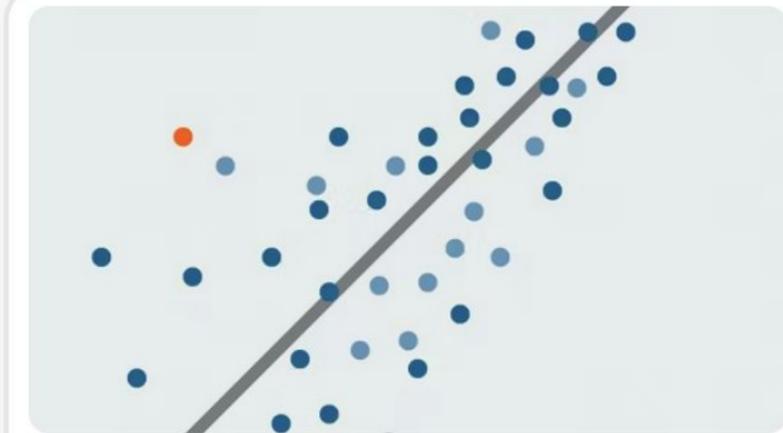
By the end of this course, you'll be equipped with a robust foundation in univariate statistical tests, enabling you to conduct rigorous data analysis, make informed decisions in research, and effectively communicate your findings.



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Course Name: Simple Linear Regression

#StatisticalAnalysis
#ResearchMethods
#DataInterpretation



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Linear Regression and Modeling

Compétences que vous acquerez: Probability & Statistics, Regression, Business Analysis, Data Analysis, General Statistics, Statistical Analysis,...

★ 4.8 (1.7k avis)

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